

MARYLAND CAREER CLUSTERS



RESTRUCTURING LEARNING FOR STUDENT ACHIEVEMENT
IN A TECHNOLOGICALLY ADVANCED, GLOBAL SOCIETY



“Public education is a joint investment. We must all work together to see that our curriculum is relevant and reflective of the real world. Our students must be actively engaged in the learning process and must have the knowledge and skills they need to transition successfully from school to postsecondary education and careers.”

Dr. Nancy S. Grasmick
State Superintendent of Schools
Maryland State Department of Education

“It is imperative that young people experience many opportunities for career development early on. We need to spark their minds and interests and get them turned on by an exciting career.”

Gino J. Gemignani, Jr.,
Chairman of the Governor's
Workforce Investment Board

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Maryland Career Clusters

MARYLAND CAREER CLUSTERS HELP HIGH SCHOOLS WORK SMARTER IN TODAY'S COMPETITIVE ECONOMY.

Maryland Career Clusters are driven by what students need to know and do in order to graduate fully prepared for further education and careers in the 21st-century global economy. Career Clusters provide important context for educational reform efforts as outlined in the Maryland State Department of Education's (MSDE) *Achievement Matters Most: Maryland's Plan for Every Student* and the Policies and Procedures for Career Technology Education (CTE) programs. Under the leadership of MSDE, Maryland business leaders organized the state's Career Cluster system.

Career Clusters have been embraced nationally at both secondary and postsecondary levels. Maryland is a recognized leader in successfully adapting the national framework to the state's economy and school reform. Local school systems and schools are using the Career Cluster system to organize teaching and learning to meet the specific needs and resources of their community.

Career Clusters also help enhance economic development. As such, Career Clusters are groupings of interrelated occupations that represent the full range of career opportunities. By connecting schools and businesses, they help ensure that Maryland has a high-quality workforce that attracts and retains businesses to the state.

MORE RELEVANT

At a time when the need for skills-driven education and high academic and technical achievement is greater than ever, we're losing many of our high school students to indifference.

While nearly 80 percent of America's high school graduates enroll in college, an increasing number require remedial help at the outset. And overall, less than half of four-year college students complete the degree within five years.

U.S. Department of Education, National Center For Education Statistics (National Longitudinal Study)

Students are struggling to find the relevance that their high school courses will have on their future.

Often they turn off and tune out. Too often students graduate from high school not properly prepared for the rigors of college and challenging careers.

Maryland Career Clusters promote student success by relating high school to their future goals and aspirations. In turn, more students can reach high levels of performance, thus closing the achievement gaps.

MORE FOCUSED

Maryland high schools are changing to better prepare every student for success after high school in higher education and challenging careers. The Maryland Career Clusters system directs students toward focused programs of study that make the high school experience more meaningful. Not unlike choosing a subject major in college, Career Clusters provide students an opportunity to select a field of interest while they are still in high school. They focus students and provide a variety of career options to pursue. When students are interested and engaged, learning takes place.

MORE INCLUSIVE

Concentrated learning in a given subject area is not a new concept in Maryland. Many local school systems have in place focused programs of study, such as International Baccalaureate; Performing Arts Magnets; Math, Science, and Technology Signatures; and Finance Academies. Career Clusters are a resource for all high schools as they reorganize into smaller learning communities. Instruction is organized around career themes, thus giving more students the opportunity to explore career choices while still in high school.

Maryland Career Clusters

MORE PREPARED

Today's knowledge-based economy demands continuous learning and innovation. It calls for a highly skilled and flexible workforce with the ability to work in cross-functional teams with people from diverse cultural and educational backgrounds. The focus is no longer on performing a single job or task. To be successful, students must be able to:

- Understand the educational requirements for success in college and the workplace;
- Manage their own careers and their need for continuing education in a constantly changing environment; and
- Identify and seek career advancement opportunities.

MORE PRODUCTIVE

Career Clusters allow business leaders to be partners in education where students can participate in more extensive career development opportunities in Maryland's growth industries. As a result, students improve their power to learn and determine their own education and career goals. Career Clusters create clear and smooth educational pathways young people can follow from kindergarten through grade 12, on to college or other postsecondary education, and into the workplace.

FEATURES AND BENEFITS OF MARYLAND CAREER CLUSTERS	
FEATURES	BENEFITS
Aligns teaching and learning with students' interests.	When students are interested in what they're learning, they stay involved and perform better.
Helps students become more self-directed and focused on their future.	Students who set goals achieve greater success in high school and beyond.
Relates classwork to students' goals and interests.	Students are motivated to work harder, enroll in more challenging courses, and make better career choices.
Provides a framework for organizing high schools into smaller learning communities.	Students receive more personalized instruction, advice, and support.
Aligns high school programs of study to college and workplace requirements.	Programs of study ready students for college and eliminate the need for remediation.
Organizes career opportunities into 10 Career Clusters.	Students, parents, and advisors understand future career possibilities, thus facilitating career decision-making.
Anticipates and responds to changes in the economy.	Business and community leaders continue to keep schools informed on the changing requirements of the workplace.
Guides the continuous improvement of career and technology education programs.	Students gain advanced standing for entry into careers.
Aligns course content to state standards.	Student achievement increases and dropout rates decrease.

“Career Clusters and Pathways provide an organization for school reform and opportunities for students to see themselves in their future.”

Barry W. Burke
Director, Career and Technology Education
Montgomery County Public Schools

Maryland Career Clusters

CAREER CLUSTERS ARE ORGANIZED AROUND 10 BROAD CAREER AREAS THAT REFLECT MARYLAND'S KEY ECONOMIC SECTORS.

Each Maryland Career Cluster encompasses a range of careers based on essential economic activities, similar interests, common skills, and training required by those in the field. When students pursue a Career Cluster, they can still explore coursework in related clusters.

Maryland's system encompasses virtually all careers and levels of education—from entry level to professional level—in the following 10 Career Clusters:

1. Arts, Media, and Communication
2. Business Management and Finance
3. Consumer Services, Hospitality, and Tourism
4. Construction and Development
5. Environmental, Agricultural, and Natural Resources Systems
6. Health and Biosciences
7. Human Resource Services
8. Information Technology
9. Manufacturing, Engineering, and Technology
10. Transportation Technologies

"I applied to the Finance Academy because of the internships...but now I see there's a whole lot more to it. I'm motivated to take advanced courses and to do better in school. I'm learning about careers that are available to me and the skills needed to succeed."

A Maryland High School Student

"Over the past two decades, 12th graders have reported a declining interest in school, while the effort they apply to their school work has generally shown no measurable change over the past decade."

*The Condition of Education 2002,
National Center For Education,
United States Department of Education*

"The partnerships being forged between the business community, state and local economic development officials and educators are a critical element of workforce development in Maryland. In the new fast-paced, global economy, it is no longer sufficient to prepare workers for today's jobs; we must teach students the skills they will need to fill the jobs of tomorrow."

*Aris Melissaratos,
Maryland Secretary of Business and Economic Development*

USING CAREER CLUSTERS, STUDENTS IDENTIFY CAREER OPTIONS CALLED CAREER PATHWAYS

Maryland business leaders worked with MSDE to define the major activities of each industry represented by the Career Cluster. These major activities became the Career Pathways for each cluster. The Career Pathways include a range of careers and the requirements for advancement in the field. Because each Career Cluster is broadly defined, there is overlapping and common content across clusters, allowing for flexibility in program design.

Career Pathways are like road maps of learning that help students plan for and pursue further education and careers. Students can explore a wide range of career options that require post-high school education and training. Students also have opportunities to apply academics and develop technical skills in a career area.

Educators use the cluster materials to develop sequential programs of study that include at least the last two years of

high school and two or more years of postsecondary education. Programs provide multiple options for students (such as early college admissions through dual enrollment, articulated credit, and advanced placement) as they prepare for further education and careers. Career and Technology Education programs of study also prepare students to earn industry-recognized credentials.

As shown in the diagram below, a high school may be organized around four Career Clusters and multiple pathways. An example of one related, CTE-focused program of study is provided for a Career Pathway within each cluster.

Not every pathway will have a corresponding program of study. However, counselors and parents must be aware of the entire scope of the industry as they guide students in planning their future.

CAREER CLUSTERS			
INFORMATION TECHNOLOGY	HEALTH AND BIOSCIENCES	ARTS, MEDIA, AND COMMUNICATIONS	MANUFACTURING, ENGINEERING, AND TECHNOLOGY
CAREER PATHWAYS			
Software Operations	Health Services	Print and Broadcast Journalism	Project Engineering
Hardware Operations	Infomatics	Visual Arts	Manufacturing Process and Quality Assurance
	Basic/Applied Research	Multimedia Production	Logistics and Inventory Control
	Manufacturing	Graphic Design and Printing	
EXAMPLES OF FOCUSED PROGRAMS OF STUDY			
Cisco Networking	Biotechnology	Multimedia Production	Project Lead the Way (Pre-Engineering)

THE PATHWAY TO ACHIEVEMENT

Underpinning Career Clusters are Maryland content standards. These standards reflect the common knowledge and skills students need for each cluster. Content standards include three components: academic, technical, and workplace skills. In Maryland, the workplace skills are known as the Skills for Success. The identified content standards inform educators as they design more challenging program sequences for a pathway.

Improved school and student performance are tied to the new Maryland School Assessment Program and the High School Assessments based on Maryland content standards that drive higher expectations for course taking.

“Students come to college better prepared, more focused and ready to acquire knowledge if they have had the type of applied or experiential learning that imparts the true application of knowledge.”

Teri Hollander

Assistant Vice Chancellor for Academic Affairs and Director of Articulation at the University System of Maryland

“More than ever, we need the support of our business partners to take education to the next level. The Career Cluster system is the answer to CTE program enhancement.”

Arnold E. Hammann

Supervisor of Enrichment and Career Technology Education
Washington County School System

“I used to think graduating from high school was the ultimate goal. Now I know it’s just a step to other things. I have set higher goals, and the Career Academy has given me the tools and self-confidence to achieve them.”

A Maryland High School Student

GUIDE TO MARYLAND’S 10 CAREER CLUSTERS

The section that follows describes in detail each of the 10 Career Clusters and their corresponding Career Pathways. Each description features a diagram of the Career Cluster, which graphically illustrates its specific features, including:

- Career Pathways that represent the major business functions within the industry/Career Cluster;
- Career Cluster knowledge and skills, or a common core of academic, technical, and workplace skills required by professionals in the industry as a whole;
- Career specialties or occupations within each Career Pathway; and
- Types of postsecondary education options and certifications that students may pursue to advance in a cluster.

The Maryland State Department of Education is providing leadership and technical assistance in the implementation of the Career Cluster system by:

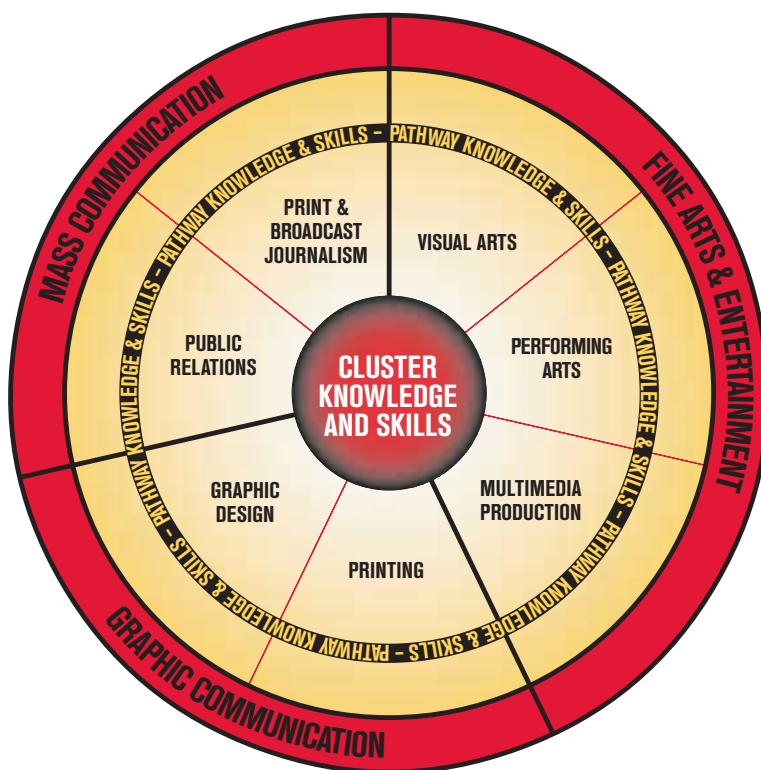
- Working with business leaders to refine and keep current the content standards;
- Helping schools use Career Clusters to establish smaller learning communities;
- Providing a K-16 career development model;
- Identifying best practices and exemplary programs; and
- Monitoring outcomes for student success.

Career Cluster 1

ARTS, MEDIA, AND COMMUNICATION

INDUSTRY INSIGHTS

- Expanded global communication and travel are increasing the multicultural content of visual and performing arts and communication products and services, and providing new audiences and markets throughout the United States and the world.
- The growing complexity and rapid pace of modern society and increased global communication and advances in information technology are contributing to an information explosion and expanding markets for mass communication products and services. These products and services include highly specialized journalistic content and coverage; including business, arts and entertainment, global events, and government. These mass communication products and services are being distributed across the full range of mass communication media, including radio, television, and the Internet; and print media, such as newspapers, books, and magazines.
- Advances in information technology are having major impacts on the visual and performing arts, business communication and advertising, and the graphic arts and printing industry. These advances also are driving the growth of multimedia production in traditional areas, such as movies and television; and new areas, such as the gaming industry.



Looking at the industry as a whole, three core areas—Fine Arts and Entertainment, Mass Communication, and Graphic Communication—organize the pathways according to major functions in the industry. Within the core areas, Career Pathways show more specific business activities that offer a range of related career opportunities. In most Career Pathways, four-year degrees or

higher are preferred and sometimes required, but appropriate work experience may be important to increase career opportunities. The center circle represents the common knowledge and skills required of anyone in this career. As students focus on a more specific Career Pathway, they advance their readiness for careers in that pathway.

Career Cluster 1

ARTS, MEDIA, AND COMMUNICATION

CORE AREA 1: FINE ARTS AND ENTERTAINMENT

PATHWAY: VISUAL ARTS

Creating, designing, developing, and producing visual arts.

- Create fine arts, design, or photographic art.
- Promote, show, and distribute visual arts through museums, galleries, retail stores, and other distribution channels.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Cartoonist• Fashion Artist• Photographer• Sketch Artist• Craftsperson• Illustrator	<ul style="list-style-type: none">• Interior Designer• Textile Designer• Animator• Museum Director• Gallery Manager• Fine Artist (i.e., painting, sculpture, ceramics)	<ul style="list-style-type: none">• Fine Artist (i.e., painting, sculpture, ceramics)• Art Historian• Museum Curator

PATHWAY: PERFORMING ARTS

Creating, designing, developing, producing, and performing in music, theater, and dance, and providing business and technical services.

- Perform as a musician, actor, dancer, and/or singer.
- Promote, manage, and support performers and performances.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Technician (i.e., audio-visual, lighting, sound, stage, props, construction, costume)• Actor• Dancer• Musician• Producer• Agent• Playwright• Light, Costume, or Sound Designer	<ul style="list-style-type: none">• Production Manager• Actor• Dancer• Musician• Director• Theater Manager• Casting Director• Playwright• Set Designer• Dance Choreographer	<ul style="list-style-type: none">• Composer• Arranger• Conductor,• Musician Coach• Dance Choreographer• Artistic Director

PATHWAY: MULTIMEDIA PRODUCTION

Creating and distributing multimedia content focused on audio, film, video, and game production, including simulation.

- Produce multimedia content.
- Market, manage, and distribute multimedia products through radio and television broadcasting and cable, retail stores, the Internet, and a wide variety of devices, including PDAs, computers, and cell phones.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Technicians (i.e., live action segments and motion capture)• Producer (i.e., film, music, radio, recording, television)• Sales Agent	<ul style="list-style-type: none">• Programmer• Game Designer• Production Manager• Web Designer• Video Designer• Screenwriter• Editor• Program Manager	<ul style="list-style-type: none">• Researcher

Career Cluster 1

ARTS, MEDIA, AND COMMUNICATION

CORE AREA 2: MASS COMMUNICATION

PATHWAY: PRINT AND BROADCAST JOURNALISM

Developing, producing, and publishing written, visual, and multimedia journalistic content through mass communication media.

- Write, present, and produce articles, stories, and related journalistic content for radio, television, the Internet, newspapers, books, and magazines.
- Provide business management services and technical support.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Software Applications Support Specialist• Electronic Technician• Audio-Visual Equipment Technician• Web Designer	<ul style="list-style-type: none">• Journalist• Novelist• Writer• Reporter• Broadcast News Analyst• Radio or Television Announcer• Operations Managers	<ul style="list-style-type: none">• Researcher• Historian• Advertising Copywriter• Editor

PATHWAY: PUBLIC RELATIONS

Providing public relations and advertising services and business communications.

- Create public relations communications for all forms of media.
- Manage and support public relations and communications operations.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Advertising Coordinator• Public Relations Assistant• Community Relations Coordinator• Advertising Layout Designer• Media Buyer	<ul style="list-style-type: none">• Speech Writer• Publicist• Public Relations Manager• Communications Manager• Advertising Manager• Writer

CORE AREA 3: GRAPHIC COMMUNICATION

PATHWAY: GRAPHIC DESIGN

Designing and developing digital images.

- Prepare digital images.
- Provide business management and technical support services.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Graphic Designer• Desktop Publisher	<ul style="list-style-type: none">• Graphic Designer• Desktop Publisher• General Manager• Operations Manager

PATHWAY: PRINTING

Printing digital images, managing business operations, and providing technical support.

- Conduct press operations.
- Use tools and procedures for quality control.
- Manage business operations, including customer service, sales/accounts, and scheduling, shipping, and distribution.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Pre-Media/Pre-Press Imaging Specialist• Bindery and Finishing Technician• Press Operator• Systems Operator• Circulation Agent	<ul style="list-style-type: none">• Pre-Press Manager• General Manager• Operations Manager

Career Cluster 1

ARTS, MEDIA, AND COMMUNICATION

CROSS-CLUSTER SKILL AREAS

In addition to focusing on a Pathway, students gain transferable skills across Career Clusters. These cross-cluster skills broaden a student's understanding of how different careers connect and intersect.

- **Information Technology and Communications Support:** Telecommunications, data and computer support services, including communications systems, devices, and equipment, computer software and hardware, and Internet services.
- **Financial Management and Accounting:** Business support services in finance and accounting.
- **Purchasing and Procurement:** Purchasing of materials and equipment for organizations involved in performing and distributing.
- **Legal Services:** Legal services that address all aspects of the business, including purchasing contracts, leases, human resources, and risk management.
- **Public Policy/Government Relations:** Managing government communications, lobbying, and managing relationships with government agencies at the federal, state, and local levels.
- **Human Resources/Training:** Business activities involved in recruitment and hiring of employees, performance reviews, compensation and benefits management, labor relations, and compliance with government laws and regulations; training and development of employees, from orientation to professional and management development.
- **Marketing and Sales:** Market analysis, advertising and promotion, sales, and customer service.
- **Health and Safety/Environmental Management:** Managing and improving health and safety, and maintaining compliance with legal and regulatory requirements, including OSHA, EPA, and CDC.

PROGRAM HIGHLIGHT

ARTS, MEDIA, AND COMMUNICATION

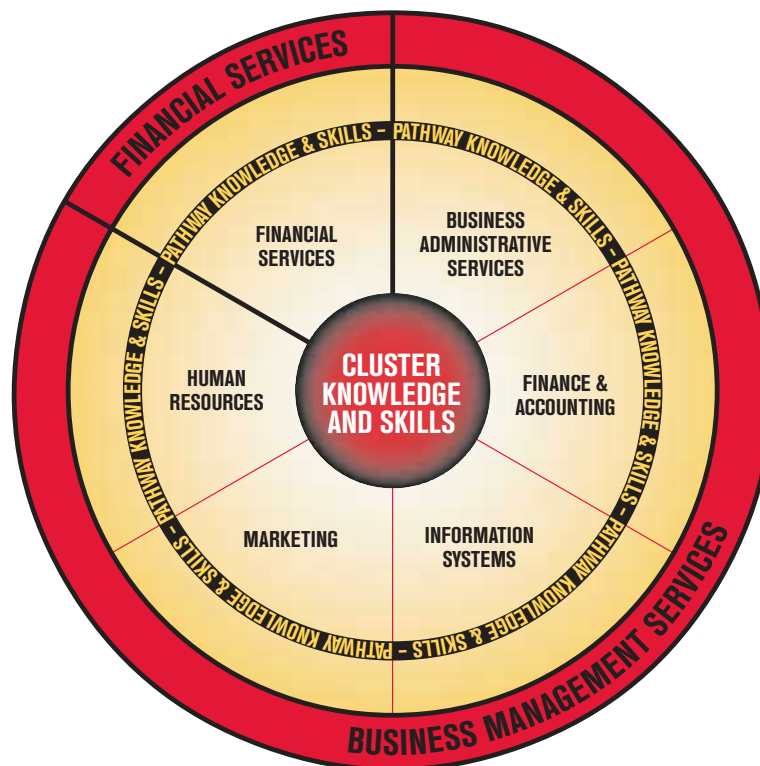
Graphic Communication programs in schools and colleges offer courses such as Press Operations, Digital File Preparation, Digital File Output, Interactive Multimedia, and advanced courses. These programs introduce students to all processes—from origination of the idea through reproduction, finishing, and distribution of two- or three-dimensional products or electronic transmissions. Involving students in the “end to end” processes of graphic communications allows them to experience the creation of high quality, “real life” products and services.

Career Cluster 2

BUSINESS MANAGEMENT AND FINANCE

INDUSTRY INSIGHTS

- The financial services industry sector is becoming increasingly integrated, with many businesses offering a complete range of investment, brokerage, depository, insurance, and lending services. This trend will require financial services professionals to develop, sell, and service a much broader range of financial products and services.
- Businesses are facing an increasingly global, rapidly changing, and competitive environment requiring business management professionals to have stronger finance, marketing and communication, legal, and management skills. They also will face major challenges in recruiting, hiring, developing, and retaining skilled workers and improving productivity, which will require innovative thinking in human resource management.
- Businesses will continue to expand the use of information technology in all aspects of the business enterprise and will seek more comprehensive e-commerce and information management solutions to remain competitive. This will require all business management professionals to have stronger information technology skills. Information technology professionals will need stronger business skills to better design and manage information technology solutions that meet business needs.



Looking at the industry as a whole, two core areas—Business Management Services and Financial Services—organize the pathways according to major functions in the industry. Within the core areas, Career Pathways show more specific business activities that offer a range of related career opportunities. In most Career Pathways, four-year degrees or higher are preferred

and sometimes required, but appropriate work experience may be important to increase career opportunities. The center circle represents the common knowledge and skills required of anyone in this career. As students focus on a more specific Career Pathway, they advance their readiness for careers in that pathway.

Career Cluster 2

BUSINESS MANAGEMENT AND FINANCE

CORE AREA 1: BUSINESS MANAGEMENT SERVICES

PATHWAY: INFORMATION SYSTEMS

Supplying business services to all major industry sectors.

- Provide telecommunications, data and computer support services, and overall e-commerce support.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Computer Support Specialist• Database Administration Associate• Network Administrator	<ul style="list-style-type: none">• Human Resources Information Systems Specialist or Manager• Systems Engineer• Network Security Analyst• Software Applications Quality Assurance Specialist• Database Knowledge Architect	<ul style="list-style-type: none">• Chief Information Officer

PATHWAY: HUMAN RESOURCES

Managing business activities related to employment and operating in compliance with government laws and regulations.

- Recruit and hire employees.
- Evaluate performance.
- Provide compensation and benefits.
- Conduct training and development.
- Manage labor relations.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Payroll Clerk• Recruiter• Trainer• Human Resources Clerk• Compensation, Benefits, and Job Analyst Specialist	<ul style="list-style-type: none">• Human Resources Manager• Employee or Labor Relations Manager• Employee Assistance Plan Manager• Training and Development Manager• Organizational Developer• Affirmative Action Coordinator

PATHWAY: FINANCE AND ACCOUNTING

Providing services concerning the assets, investments, liabilities, and operating results of a business.

- Manage, audit, and prepare financial and tax reports.
- Provide financial investing and borrowing services.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Credit Analyst• Accounting Clerk• Accounts Payable/Receivable Clerk	<ul style="list-style-type: none">• Accountant• Investment Banker• Financial Analyst• Budget Analyst• Auditor• Tax Analyst	<ul style="list-style-type: none">• Economist• Chief Financial Officer• Treasurer• Controller• Finance Director

Career Cluster 2

BUSINESS MANAGEMENT AND FINANCE

PATHWAY: MARKETING

Strategizing business activities related to selling, customer support services, and public relations.

- Analyze customer markets.
- Determine product mix, pricing, promotion, distribution, and public relation strategies.
- Provide customer support services.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Buyer • Sales Representative • Customer Service Representative 	<ul style="list-style-type: none"> • Marketing Manager • Market Research Analyst • Advertising and Promotions Manager • Public Relations Specialist • Media Coordinator

PATHWAY: BUSINESS ADMINISTRATIVE SERVICES

Business activities involved in providing administrative support throughout organizations.

- Manage information.
- Provide computer applications support.
- Develop and manage report/document production, communication, planning, and organization.
- Coordinate meetings and events.
- Manage the general office.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Office Manager • Administrative Assistant • Secretary • Data Entry Specialist • Computer Support Specialist 	<ul style="list-style-type: none"> • Administrative Services Manager • General Manager • Operations Manager

CORE AREA 2: FINANCIAL SERVICES

PATHWAY: FINANCIAL SERVICES

Selling, delivering, and supporting investment, brokerage, depository, insurance, and lending services.

- Provide sales and services functions across a broad array of financial products and services.
- Research and develop new financial products and services, including pricing based on changing financial risks and market demand.
- Provide transactional services.
- Evaluate and control risk in providing financial services.
- Manage relationships with major investors.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Securities/Commodities Sales Agent • Brokerage Clerk • Insurance Agent • Bank Teller • Loan Processor • Insurance Policy Processor • Insurance Claims Agent and Investigator 	<ul style="list-style-type: none"> • Personal Financial Advisor • Investment Advisor • Financial Analyst • Loan Officer • Bank Operations Manager • Underwriter • Insurance Appraiser • General Manager • Operations Manager 	<ul style="list-style-type: none"> • Economist • Actuary • Statistician

Career Cluster 2

BUSINESS MANAGEMENT AND FINANCE

CROSS-CLUSTER SKILL AREAS

In addition to focusing on a Pathway, students gain transferable skills across Career Clusters. These cross-cluster skills broaden a student's understanding of how different careers connect and intersect.

- **Customer Support:** Providing sales and service support through call centers, help desks, and online services, requiring strong communications and customer service skills similar to customer service representatives.
- **Community Relations:** Managing relationships with local communities, including activities required under community reinvestment laws.
- **Regulatory Compliance:** Operating in compliance with government laws and regulations.
- **Equipment Maintenance:** Maintaining and repairing office equipment and related information processing equipment.
- **Security:** Private and public security services that protect the assets and lives of customers and employees.

BUSINESS MANAGEMENT AND FINANCE

PROGRAM HIGHLIGHT

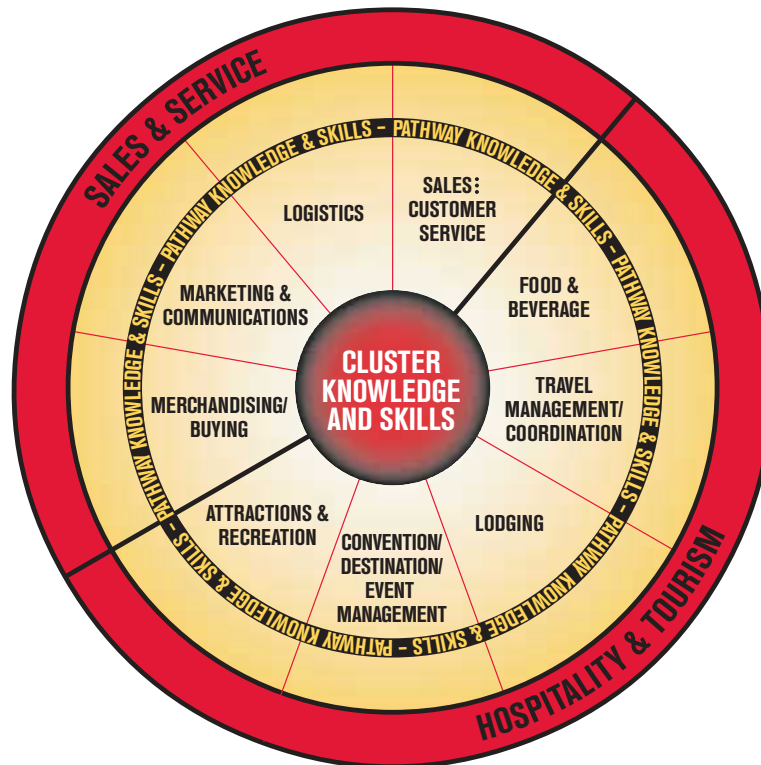
Maryland's National Academy of Finance program features two specialized courses each semester and a college level course in the senior year. The program offers courses such as Financial Services, Economics, Banking and Credit, Securities, International Finance, Financial Planning, and Insurance. Finance Academies introduce students to the broad career opportunities in the financial services industry and equip them to make sound choices for the future.

Career Cluster 3

CONSUMER SERVICES, HOSPITALITY, AND TOURISM

INDUSTRY INSIGHTS

- Global trade, travel, technological advances, and growing consumer income continue to expand the consumer services sector, including the range of products and services and the growth of a wide variety of retail businesses and Internet sales.
- Increased competition will continue to force wholesale and retail businesses to find new ways to provide high levels of customer service at lower costs. Advances in logistics, inventory management, and information technology are leading to major innovations for responding to customer needs and controlling inventory costs.
- Expanded global leisure and business travel and growing consumer spending on leisure and tourism activities continue to drive the growth of the hospitality and tourism sector. States and local communities will increase the promotion of destination events and tourism to attract outside spending and economic development. These trends are also promoting innovations and cultural diversification in the restaurant industry with an expanded spectrum of cuisines and services provided to customers.



Looking at the industry as a whole, two core areas—Sales and Service and Hospitality and Tourism—organize the pathways according to major functions in the industry. Within the core areas, Career Pathways show more specific business activities that offer a range of related career opportunities. In most Career Pathways, four-year degrees or higher are preferred and

sometimes required, but appropriate work experience may be important to increase career opportunities. The center circle represents the common knowledge and skills required of anyone in this career. As students focus on a more specific Career Pathway, they advance their readiness for careers in that pathway.

Career Cluster 3

CONSUMER SERVICES, HOSPITALITY, AND TOURISM

CORE AREA 1: SALES AND SERVICE

PATHWAY: MERCHANDISING/BUYING

Providing products and services for sale to customers.

- Analyze, plan, purchase, price, and allocate products and services.
- Conduct purchasing negotiations.
- Manage supplier/vendor relationships.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE

- Assistant Buyer
- Buying Clerk
- Visual Display Designer

REQUIRES FOUR-YEAR COLLEGE DEGREE

- General Merchandise Manager
- Divisional Merchandise Manager
- Merchandise Manager
- Category Manager
- Buyer

PATHWAY: MARKETING AND COMMUNICATIONS

Determining customer needs and product preferences, positioning product/service mix in the market, and communicating to and educating the customer to retain interest.

- Conduct market research to determine customer needs and product preferences.
- Develop major messages.
- Provide creative services for advertising and promotion.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE

- Visual Display Designer
- Advertising Coordinator
- Public Relations Assistant
- Community Relations Coordinator
- Advertising Layout Designer
- Media Buyer

REQUIRES FOUR-YEAR COLLEGE DEGREE

- Marketing Director
- Marketing Manager
- Marketing Analyst
- Creative Services/Advertising Manager

PATHWAY: LOGISTICS

Planning and managing the distribution of products and services to the point of sale, and the post-sale delivery of products and services to the customer.

- Sort and organize merchandise at warehouses and distribution centers, and transport.
- Process returned or damaged merchandise.
- Manage inventory.
- Prepare merchandise for sale, including marking.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE

- Warehouse Manager/ Supervisor/Team Leader
- Security/Loss Prevention Specialist
- Inventory/Quality Control Specialist
- Inventory System Specialist

REQUIRES FOUR-YEAR COLLEGE DEGREE

- Division/District Manager
- Department Manager
- Traffic Manager
- Industrial Engineer
- Transportation Planner/ Analyst
- Logistics Manager

Career Cluster 3

CONSUMER SERVICES, HOSPITALITY, AND TOURISM

PATHWAY: SALES: CUSTOMER SERVICE

Managing the sales process and overall consumer relationship, including assessing customer need and providing ongoing support before and after sales of products and services.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Department Manager• Branch Manager• Sales Manager/Agent/Associate• Account Representative• Real Estate Agent• Cosmetologist	<ul style="list-style-type: none">• General/Regional Manager• Branch Manager• Sales Manager• Territory Manager• Sales Associate• Salon Manager

CORE AREA 2: HOSPITALITY AND TOURISM

PATHWAY: FOOD AND BEVERAGE

Making, selling, and serving food and beverages to the public for a fee, including services by restaurants, catering, and institutional food providers, and other recreational and entertainment venues.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Restaurant Owner• Sales Manager• Host/Hostess• Chef• Kitchen Manager• Maitre d'	<ul style="list-style-type: none">• General Manager• Food Service Supervisor• Executive Chef• Menu Planner• Nutritionist

PATHWAY: LODGING

Providing sleeping space to guests for a fee in facilities such as hotels, bed and breakfasts, hostels, campgrounds, resorts, and cruise ships.

- Market and sell lodging services.
- Maintain facilities.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Housekeeping Director• Reservations Manager• Front Office Manager• PBX/Reservations Agent• Front Desk Clerk• Concierge• Bell Captain• Chief Engineer• Network Manager	<ul style="list-style-type: none">• Lodging Owner/Franchisee• General Manager• Engineering Director• Sales Director• Marketing Director• Rooms Director• Activities Director

Career Cluster 3

CONSUMER SERVICES, HOSPITALITY, AND TOURISM

PATHWAY: ATTRACTIONS AND RECREATION

Providing recreation, amusement, and leisure services to visitors at recreational, historic, amusement, heritage, and cultural sites, including museums, parks and zoos, marinas, campgrounds, and recreational vehicle parks.

- Market and sell recreational services and activities in resorts and on cruise ships, at specialized retail centers, and at facilities for skiing, sailing, golf, and other outdoor recreational sports.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Business Owner• Theme Park Manager• Program Manager/Director• Recreation Instructor• Counselor• Interpreter• Promotion Manager• Corporate/Community Development Coordinator	<ul style="list-style-type: none">• General Manager• Property Manager• Theme Park Manager• Park Ranger

PATHWAY: CONVENTION/DESTINATION/ EVENT MANAGEMENT

Planning, organizing, and implementing special events for the public, such as festivals, fairs, sporting events, exhibitions, conventions, and convocations.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Group Sales Agent• Product Development Specialist• Destination Manager• Activities Director• Tourism Specialist• Facility Manager• Security Manager	<ul style="list-style-type: none">• Market Researcher• Events Planner/Manager• Account Executive

PATHWAY: TRAVEL MANAGEMENT/ COORDINATION

Planning, organizing, and facilitating travel from one location to another for leisure or business away from home.

- Market, promote, coordinate, and sell travel services.
- Provide transportation services.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Sales/Marketing Manager• Contract Manager• Travel Agency Manager• Tour Broker• Travel Agent	<ul style="list-style-type: none">• General Manager

Career Cluster 3

CONSUMER SERVICES, HOSPITALITY, AND TOURISM

CROSS-CLUSTER SKILL AREAS

In addition to focusing on a Pathway, students gain transferable skills across Career Clusters. These cross-cluster skills broaden a student's understanding of how different careers connect and intersect.

- **Information Technology and Communications Support:** Telecommunications, data, and computer support services to the core business functions of the sales and service industry, including point of sale and security electronics, communications systems and devices, film and audio-visual services and equipment, computer software and hardware, and Internet services.
- **Financial Management:** Business support services in finance and accounting.
- **Legal Services:** Legal services that address all aspects of the business, including purchasing contracts, leases, human resources, and risk management.
- **Government Relations:** Managing government communications, lobbying, and managing relationships with government agencies at the federal, state, and local levels.
- **Human Resources/Training:** Business activities involved in recruiting and hiring employees, conducting performance reviews, managing compensation and benefits, handling labor relations, and complying with government laws and regulations; training and developing of employees, ranging from orientation to professional and management development.
- **Risk Management:** Business support services to provide health, safety, and environmental protection and insurance for employees and customers; loss prevention for merchandise and facilities; compliance with government laws and regulations; security.
- **Maintenance/Facility Support:** Maintaining physical facilities, from architecture, design services, facility, and equipment maintenance services, to building cleaning services, landscape and grounds planning, and maintenance.

CONSUMER SERVICES, HOSPITALITY, AND TOURISM

PROGRAM HIGHLIGHT

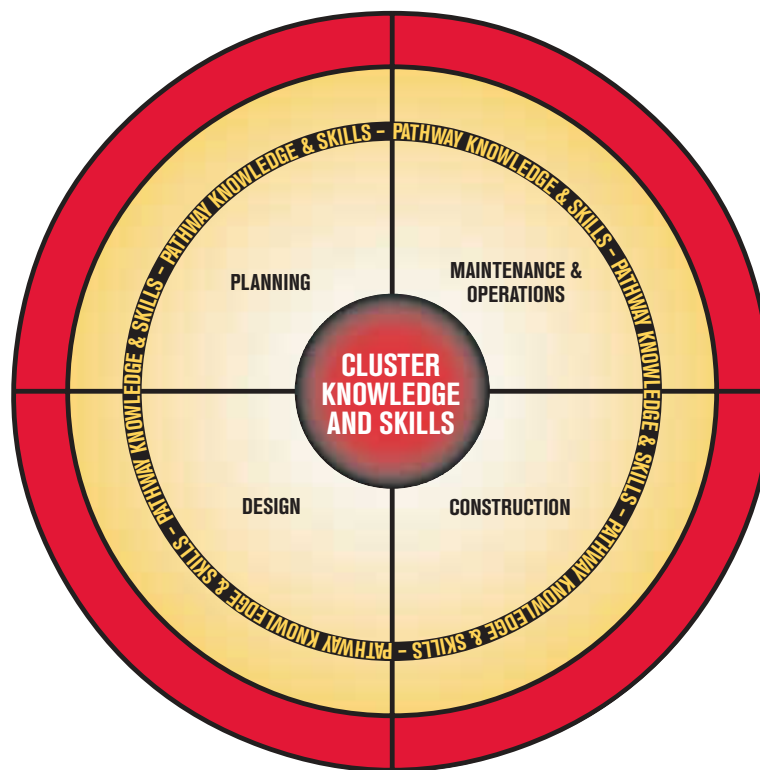
Maryland's Academy of Travel and Tourism offers an in-depth look at all aspects of travel, tourism, and hospitality, including coursework in geography, economics, and systems applications. Two specialized courses are featured each semester and a college-level course is offered in the senior year. The program equips students with the personal, analytical, technical, and communication skills they need to succeed.

Career Cluster 4

CONSTRUCTION AND DEVELOPMENT

INDUSTRY INSIGHTS

- Population and economic growth and the transformation of major metropolitan areas will continue to fuel the demand for more residential and commercial building construction and the need to expand and upgrade the public infrastructure, including transportation.
- The construction industry faces a more complex political, social, and economic environment for the planning of residential, commercial, and public infrastructure projects. Construction professionals face challenges in creating plans and designs for major projects that meet more stringent government requirements and gain the support of multiple stakeholders. The construction and development sector also faces new challenges in managing complex construction projects so that projects are completed on time and meet customer requirements for quality and costs.
- Advances in science and technology will continue to drive innovation in the design, construction, and maintenance of buildings and infrastructure, including new design concepts, construction materials and methods, and the application of information technology.



Looking at the industry as a whole, four pathways represent the major functions in the industry. Career Pathways show more specific business activities that offer a range of related career opportunities. In most Career Pathways, four-year degrees or higher are preferred and sometimes required, but appropriate

work experience may be important to increase career opportunities. The center circle represents the common knowledge and skills required of anyone in this career. As students focus on a more specific Career Pathway, they advance their readiness for careers in that pathway.

Career Cluster 4

CONSTRUCTION AND DEVELOPMENT

PATHWAY: PLANNING

Planning of construction projects, including the market analysis that determines the need for the project and builds public-private support; environmental impact; and the financial analysis that determines costs and financing requirements.

- Develop concept, feasibility analysis, and master plan.
- Manage business and marketing aspects.

PATHWAY: DESIGN

Designing and engineering physical structures from original concept to complete architectural and engineering plans for the development of land sites and the physical structures built on sites.

- Develop budget.
- Program all elements of project.
- Develop concepts/schematics and construction documents.
- Determine construction support.
- Manage business and marketing aspects.

PATHWAY: CONSTRUCTION

Conducting the bidding and award process and actual construction of physical structures, including land development, general contracting, and special trades contracting activities.

- Procure labor, materials, and subcontractors.
- Construct site.
- Conduct inspection, closeout/acceptance, and warranty processes.
- Manage business and marketing aspects.

PATHWAY: MAINTENANCE AND OPERATIONS

Managing, operating, and maintaining/repairing existing physical structures.

- Provide warranty and repair services.
- Maintain landscape.
- Manage business and marketing aspects.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Construction Manager • Civil Engineering Technician 	<ul style="list-style-type: none"> • Architect • Financial Analyst • Environmental Engineer • Civil Engineer • Land Surveyor 	<ul style="list-style-type: none"> • Urban and Regional Planner

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Construction Manager • Drafter/CAD Technician 	<ul style="list-style-type: none"> • Engineers (all types) • Architect • Specifications Writer • Environmental Scientist

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Construction Manager • Drafter/CAD Technician • Building Code Inspector • Plumber • Carpenter • Electrician 	<ul style="list-style-type: none"> • Engineers (all types) • Project Manager

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Real Estate Manager • Facility Manager • Construction Occupations (all trades) • Heating, Ventilation, Air Conditioning, Refrigeration Technician 	<ul style="list-style-type: none"> • Engineers (all types) • Project Manager • Cost Estimator

Career Cluster 4

CONSTRUCTION AND DEVELOPMENT

CROSS-CLUSTER SKILL AREAS

In addition to focusing on a Pathway, students gain transferable skills across Career Clusters. These cross-cluster skills broaden a student's understanding of how different careers connect and intersect.

- **Code Review:** Public and private activities involved in ensuring that construction projects are in compliance with government regulations and building codes.
- **Equipment Maintenance:** Maintaining the reliability and performance of construction equipment including preventive maintenance and repair.
- **Quality Assurance:** Business activities that ensure construction projects are using processes for buildings and physical structures to meet quality standards.
- **Information Technology:** Business services that provide telecommunications, data and computer support services, and overall e-commerce support to the core business functions.
- **Human Resources:** Recruitment and hiring of employees, performance reviews, compensation and benefits management, labor relations, and compliance with government laws and regulations.
- **Training:** Training and development of construction employees ranging from orientation and safety training to apprenticeship training for specific trades.
- **Marketing:** Promotion and selling of construction projects and the overall business to targeted markets.
- **Risk Management:** Prevention and management of financial losses due to a range of causes, including accidents and injuries, theft, and environmental impacts.
- **Environmental Management:** Management and reduction of risks associated with environmental impacts and ensure compliance with government laws and regulations.
- **Safety:** Management and reduction of risks associated with health and safety, and compliance with government laws and regulations.
- **Legal:** Legal services that address all aspects of the business, including contracts, human resources, and risk management.
- **Finance:** Financial services that address the financing needs of construction projects and the overall business.
- **Accounting:** Accounting services that manage the revenues and costs of construction projects and the overall business.
- **Apprenticeship:** Apprenticeship programs that prepare workers for construction trades.
- **Labor Union Management:** Business, operational, and political activities involved in the operation and management of labor unions, including activities carried out by political directors and legislative relations.

PROGRAM HIGHLIGHT

CONSTRUCTION AND DEVELOPMENT

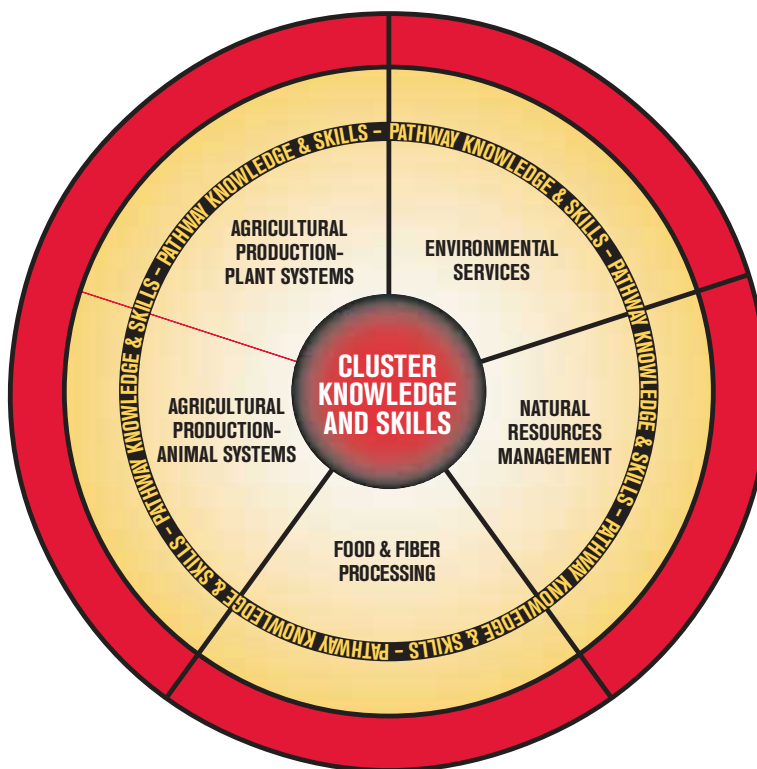
Construction and Development programs offer opportunities for students to pursue interests in developing, designing, constructing, and maintaining the built environment. Students in the Construction Pathway learn basic design as well as plumbing, electrical, and carpentry skills as they earn advanced standing in apprenticeship programs or college credit in postsecondary construction programs. Many schools provide students the opportunity to construct a house under the guidance of professional mentors. Students learn first-hand all aspects of the construction process from design to finish.

Career Cluster 5

ENVIRONMENTAL, AGRICULTURAL, AND NATURAL RESOURCE SYSTEMS

INDUSTRY INSIGHTS

- The agricultural sector is a highly competitive global industry creating new challenges in identifying global and domestic markets; improving business planning, financing, risk management, and productivity; and reducing costs. This sector also will continue to face more stringent requirements for food quality and environmental and natural resource management.
- Advances in science and technology, in particular biotechnology, will continue to drive innovation and growth in agricultural production and food processing through the development of new markets, products, and processes. In addition, advances in information technology will continue to improve the planning and management of agricultural production.
- Growing public concerns over natural resources, environmental quality, and public health will continue to expand the role and scope of the natural resource management and environmental services sectors. There will be increased public and private efforts to improve the management of both public and private natural resources, including water, air, and land quality, and waste management. Advances in science, biotechnology, and information technology will drive major innovations in environmental and natural resources management.



Looking at this industry as a whole, five pathways represent the major functions in the industry. Career Pathways show more specific business activities that offer a range of related career opportunities. In the Career Pathways, career options are divided fairly evenly among those requiring less than a four-year college degree, those requiring a four-year college degree, and those

requiring more than a four-year college degree. Appropriate work experience may also be important to increase career opportunities. The center circle represents the common knowledge and skills required of anyone in this career. As students focus on a more specific Career Pathway, they advance their readiness for careers in that pathway.

Career Cluster 5

ENVIRONMENTAL, AGRICULTURAL, AND NATURAL RESOURCE SYSTEMS

PATHWAY: AGRICULTURAL PRODUCTION — PLANT SYSTEMS

Planning, producing, and distributing plant food, fiber, ornamental, and environmental products, including landscaping and horticultural services; related research and technical services, and business planning and finance.

- Conduct market and location analysis, soil testing, and product testing/selection.
- Plan, manage, and control materials purchasing, land preparation, production, product quality control, inventory, and biosecurity.
- Manage health, safety, and environmental practices.
- Conduct research for new markets, products and processes (genetic research).
- Develop and test advanced applications of biotechnology.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Field Production or Farm Manager• Compliance Manager• Arborist• Landscaper• Florist	<ul style="list-style-type: none">• Soil Scientist• Geographic Information Systems Specialist• Nutrient Manager• IPM/Pest Control Specialist• Agronomist• Soil Conservation Planner	<ul style="list-style-type: none">• Plant Scientist• Research Project Manager• Geneticist• Patent Lawyer• Entomologist• Plant Pathologist• Tissue Culture Specialist• Plant Breeder• Landscape Architect

PATHWAY: AGRICULTURAL PRODUCTION — ANIMAL SYSTEMS

Planning, producing, and distributing meat, poultry, seafood, and dairy products; related research and technical services; business planning and finance (includes aquaculture).

Providing veterinarian services.

Raising horses.

- Conduct market and location analysis, soil testing, and product testing/selection.
- Plan, manage and control materials purchasing, production, product quality control, inventory, and biosecurity.
- Conduct research for new markets, products, and processes (genetic research).
- Develop and test advanced applications of biotechnology.
- Plan for risk management.
- Manage health, safety, and environmental practices.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Animal Production Manager• Horse Trainer• Environmental Technician• Veterinary Technician	<ul style="list-style-type: none">• Geographic Information Systems Specialist• Nutritionist• Inspector• Soil Conservation Planner	<ul style="list-style-type: none">• Veterinarian• Geneticist• Product Developer• Production Quality Assurance Manager• Research Scientist• State Health Official

Career Cluster 5

ENVIRONMENTAL, AGRICULTURAL, AND NATURAL RESOURCE SYSTEMS

PATHWAY: FOOD AND FIBER PROCESSING

Researching and developing products focused on nutritional value; processing and packaging plant and animal products.

- Convert harvested plant and animal materials into end-use products.
- Plan and manage production, including process engineering, quality assurance and food safety, health, worker safety, environmental compliance, and industrial maintenance.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Buyer • Inspector • Logistics and Inventory Manager • Meat Grader • Production Supervisor 	<ul style="list-style-type: none"> • New Product Scientist • Laboratory Technician • International Marketing and Packaging Manager • Nutrition Scientist • Industrial Engineer 	<ul style="list-style-type: none"> • Information Systems Manager

PATHWAY: NATURAL RESOURCES MANAGEMENT

Managing, conserving, and restoring natural resources, such as parks, fisheries, forestry, wildlife and habitat, watersheds and tributaries; and the environmental monitoring of power plants.

- Plan and manage public and private natural resources and inventory.
- Conduct scientific testing, monitoring, and research.
- Develop and maintain natural resource areas, including civil engineering and construction.
- Improve the education and awareness of users about natural resources.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Natural Resources Police Officer • Forestry Technician • Naturalist • Fishery Technician • Hatchery Technician 	<ul style="list-style-type: none"> • Environmental Engineer • Ecological Engineer • Policy Analyst • Forester • Fisheries Manager • Soil Conservation Planner 	<ul style="list-style-type: none"> • Biologist • Physical Scientist • Wildlife Manager

PATHWAY: ENVIRONMENTAL SERVICES

Planning, testing, monitoring, maintaining, and restoring water, air, and land quality and waste management for the protection of public health and environmental quality.

- Provide scientific research, safety, and technical support services, including geological measurement and geographic information systems; law enforcement; and compliance monitoring and permitting.
- Communicate to and educate the public on maintaining environmental quality and respond to environmental and public health emergencies.
- Manage all types of water resources.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Hazardous Materials Specialist • Lead/Abatement Technician • Environmental Technician • Emergency Response Technician 	<ul style="list-style-type: none"> • Planner • Geologist • Water Resource Engineer • Environmental Compliance Specialist • Health Physicist • Public Health Engineer • Air Quality Manager 	<ul style="list-style-type: none"> • Water Quality Manager • Toxicologist • Land Use/Environmental Engineer • Industrial Hygienist

Career Cluster 5

ENVIRONMENTAL, AGRICULTURAL, AND NATURAL RESOURCE SYSTEMS

CROSS-CLUSTER SKILL AREAS

In addition to focusing on a Pathway, students gain transferable skills across Career Clusters. These cross-cluster skills broaden a student's understanding of how different careers connect and intersect.

- **Information Technology and Communications Support:** Telecommunications, data, and computer support services, including communications systems and devices, film and audio-visual services and equipment, computer software and hardware, and Internet services.
- **Financial and Business Services:** Financial, sales, and distribution services to producers of agricultural products, including capital and land acquisition, banking, financial management and insurance, sales and product support, customer inventory, management, and storage.
- **Agricultural and Environmental Engineering:** Maintaining and supporting technological systems used to produce, store, and distribute agricultural and natural resource products, including production and production control equipment, structural facilities, and irrigation equipment.
- **Strategic Planning:** Long-range business planning to set the overall direction of the business and respond to projected changes in environmental conditions.
- **Legal Services:** Legal services that address all aspects of the organization, including purchasing contracts, leases, human resources, and risk management.
- **Government Relations/Legislative Affairs:** Managing government communications, lobbying, and managing relationships with government agencies at the federal, state, and local levels.
- **Human Resources/Training:** Business activities involved in recruiting and hiring employees, conducting performance reviews, compensation and benefits management, labor relations, and compliance with government laws and regulations, training and development of employees ranging from orientation to professional and management development.
- **International Marketing and Distribution:** International market analysis and management of product exporting.
- **Transportation Services:** Transporting agricultural and natural resource products by water, rail, land, and air.
- **University Research, Teaching, and Outreach:** Technical and educational services provided by universities to support agriculture and natural resource management.

PROGRAM HIGHLIGHT

ENVIRONMENTAL, AGRICULTURAL, AND NATURAL RESOURCE SYSTEMS

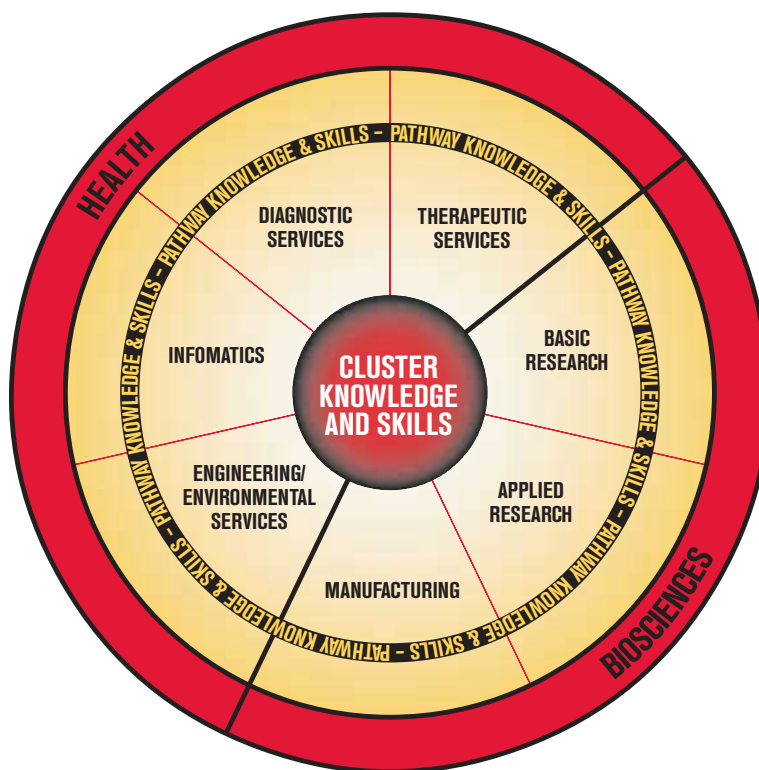
Agricultural programs give students the opportunity to incorporate and apply what they have learned in their academic disciplines while preparing them to enter Maryland's largest industry. Specific courses range from traditional production management and agricultural mechanics to biotechnology, veterinary science, and aquaculture. Programs offer students hands-on learning experience through use of specialized equipment and participation in supervised projects outside of the classroom.

Career Cluster 6

HEALTH AND BIOSCIENCES

INDUSTRY INSIGHTS

- The aging of the American population, advances in medical knowledge and technology, and growing public awareness of health issues are contributing to a growing demand for high-quality healthcare services.
- The healthcare industry will continue to shift the focus to prevention, the promotion of wellness, and the improvement of the health status of patients and communities over time. The healthcare industry also will continue to face strong cost containment and competitive pressures and will seek new ways to improve patient satisfaction and health. The industry will continue to move the delivery of healthcare services from hospitals and residential care facilities to ambulatory or outpatient care facilities and home-based care.
- Advances in bioscience, information technology, and biomedical technology will drive continuous innovation in patient care. Healthcare professionals will need stronger science and information technology skills. Stronger relations between healthcare and bioscience industries in developing, testing, and implementing new products and services will be required.
- Advances in bioscience will continue to drive major innovations and create new business opportunities across most major industries, including agriculture, natural resource management, environmental services, forensics services, manufacturing, and healthcare.



Looking at this industry as a whole, two core areas—Health and Biosciences—organize the pathways according to major functions in the industry. Within the core areas, Career Pathways show more specific business activities that offer a range of related career opportunities. In the Career Pathways, career options are divided fairly evenly among those requiring less than a four-year college degree, those requiring a four-year college

degree, and those requiring more than a four-year college degree. Appropriate work experience may also be important to increase career opportunities. The center circle represents the common knowledge and skills required of anyone in this career. As students focus on a more specific Career Pathway, they advance their readiness for careers in that pathway.

Career Cluster 6

HEALTH AND BIOSCIENCES

CORE AREA 1: HEALTH

PATHWAY: THERAPEUTIC SERVICES

Promoting wellness and improving the health statistics of patients and communities over time.

- Use technology to provide physical, mental health, and social services to improve health status.
- Collect data, create treatment plans, implement procedures, and evaluate client status.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Respiratory Care Technician • Licensed Practical Nurse • Nurse Extender • Dental Hygienist • Massage Therapist • Radiation Technician • Radiologic Technologist • Pharmacy Technician • Surgical Technician • Medical Assistant • Paramedic • Mental Health Technician 	<ul style="list-style-type: none"> • Nurse • Dietician • Occupational Therapist • Surgical Technologist • Medical Assistant • Athletic Trainer • Physician Assistant • Emergency/Medical Services Paramedic • Respiratory Therapist 	<ul style="list-style-type: none"> • Genetic Counselor • Audiologist • Physician • Psychologist • Chiropractor • Optometrist • Pharmacist • Physical Therapist • Nurse Practitioner • Speech and Language Pathologist

PATHWAY: DIAGNOSTIC SERVICES

Collecting images or data on the health status of the client at a single point of time.

- Plan and conduct diagnostic procedures.
- Evaluate, interpret, and document results.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Medical Laboratory Technician • Phlebotomist • Emergency Medical Technician • Radiologic Technologist • Cardiovascular Technician 	<ul style="list-style-type: none"> • Radiation/Oncology Therapist • Sonographer • Occupational Therapist • Social Worker Associate • Medical Laboratory Technologist 	<ul style="list-style-type: none"> • Physician • Psychologist • Nurse Practitioner • Physical Therapist • Speech and Language Pathologist

PATHWAY: INFOMATICS

Documenting client care.

- Determine information requirements and information analysis.
- Determine abstracting and coding, information systems, and documentation.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Medical Records Administrator • Medical Records/Health Information Technician • Administrative Medical Assistant • Medical Office Assistant 	<ul style="list-style-type: none"> • Health Insurance Manager • Utilization Manager • Corporate Compliance Officer • Health Information Coder 	<ul style="list-style-type: none"> • Medical Librarian

Career Cluster 6

HEALTH AND BIOSCIENCES

PATHWAY: ENGINEERING/ ENVIRONMENTAL SERVICES

Providing direct or indirect client care and creating a therapeutic environment for providing that care.

- Implement aseptic procedures, aesthetics, and resource management.
- Maintain and support biomedical technology and the physical facility.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Biomedical Equipment Technician• Biomedical Engineer• Materials Manager• Transport Technician	<ul style="list-style-type: none">• Safety Manager/Engineer	<ul style="list-style-type: none">• Biomedical Engineer

CORE AREA 2: BIOSCIENCES

PATHWAY: BASIC RESEARCH

Participating in scientific exploration with direct or indirect applications to the improvement of the quality of life.

- Generate large-scale and small-scale data, and analyze.
- Conduct strategic planning and forecasting.
- Prepare documentation, publication, and budget.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Documentation Specialist• Research Assistant• Production Technician• Materials Management Specialist	<ul style="list-style-type: none">• Regulatory Affairs Associate• Laboratory Technician• Research Technician• Technical Writer	<ul style="list-style-type: none">• Regulatory Affairs Officer• Quality Control/Assurance Director• Bioinformatics Analyst/Engineer• Bioethicist• Research Scientist• Medical Review Officer

Career Cluster 6

HEALTH AND BIOSCIENCES

PATHWAY: APPLIED RESEARCH

Testing and evaluating new products and services in laboratory and field environments and developing systems for producing products for large-scale use.

- Conduct legal reviews.
- Determine safety and efficacy of new products.
- Develop testing designs.
- Develop and acquire limited quantities of products and related materials for conducting tests.
- Conduct tests and field trials and analyze and present results.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Research Assistant • Quality Control Specialist • Validation Engineer • Process Engineer • Compliance Training Specialist • Production Technician 	<ul style="list-style-type: none"> • Regulatory Affairs Associate • Laboratory Technician • Research Technician • Technical Writer 	<ul style="list-style-type: none"> • Medical Review Officer • Clinical Trials Manager • Manufacturing Director

PATHWAY: MANUFACTURING

Producing bioscience products, such as vaccines and laboratory materials, on a commercial scale.

- Implement, manage, operate, and maintain production systems.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Manufacturing Technician • Validation Engineer • Technical Training Specialist • Production Planner 	<ul style="list-style-type: none"> • Operations Manager • Quality Manager/Technician • Manufacturing/Chemical Engineer • Analytical Chemist • Microbiologist 	<ul style="list-style-type: none"> • Medical Director • Senior Methodologist • Senior Scientist • Medical Science Liaison • Regulatory Affairs Officer • Manufacturing Director

Career Cluster 6

HEALTH AND BIOSCIENCES

CROSS-CLUSTER SKILL AREAS

In addition to focusing on a Pathway, students gain transferable skills across Career Clusters. These cross-cluster skills broaden a student's understanding of how different careers connect and intersect.

- **Information Technology and Communications Support:** Telecommunications, data, and computer support services to core business functions of sales and service and of the research and manufacturing industries, including communications systems and devices, film and audio-visual services and equipment, computer software and hardware, and Internet services.
- **Business Management/Managed Care:** Managing healthcare finances associated with insurance and managed care organizations.
- **Financial Management and Accounting:** Business support services in finance and accounting.
- **Legal Services:** Legal services that address all aspects of the business, including purchasing contracts, leases, human resources, and risk management.
- **Public Policy/Government Relations:** Managing government communications and lobbying and managing relationships with government agencies at the federal, state, and local levels.
- **Human Resources/Training:** Business activities involved in recruitment and hiring of employees, performance reviews, compensation and benefits management, labor relations, and compliance with government laws and regulations. It also refers to the training and development of employees, ranging from orientation to professional and management development.
- **Risk Management:** Business support services providing health, safety, and environmental protection and insurance for employees and customers; loss prevention for both merchandise and facilities; compliance with government laws and regulations; and security.
- **Maintenance/Facility Support:** Maintaining physical facilities, including architecture and design services, facility and equipment maintenance services, building cleaning services, landscape and grounds planning, and maintenance.
- **Marketing and Sales:** Market analysis, advertising and promotion, sales, and customer service.
- **Accreditation:** Attaining and maintaining organizational accreditation.
- **Health and Safety/Environmental Management:** Managing and improving health and safety and maintaining compliance with legal and regulatory requirements, including OSHA, EPA, MOSH, and CDC.

PROGRAM HIGHLIGHT

HEALTH AND BIOSCIENCES

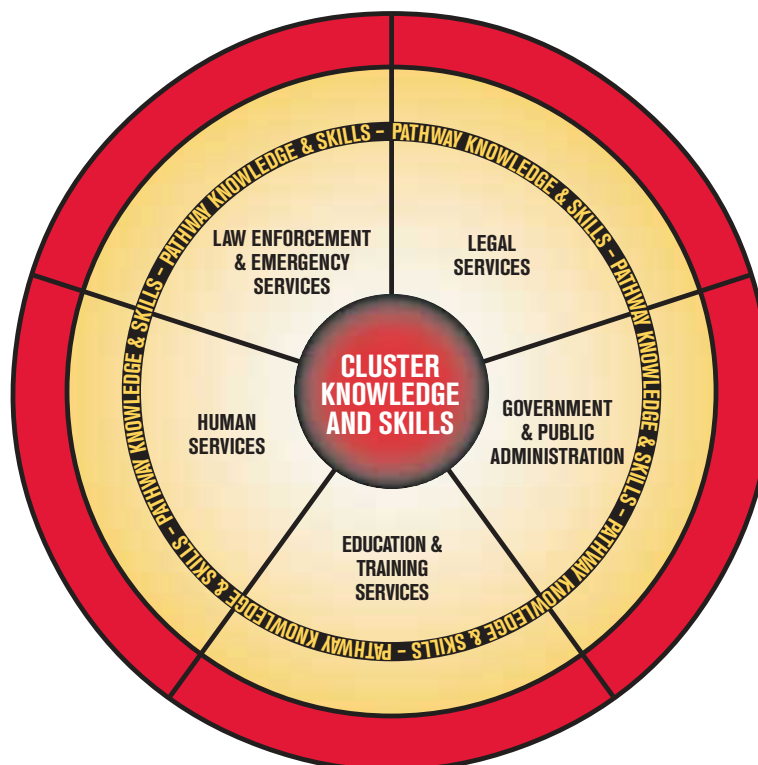
Medical Careers programs offer students the opportunity to develop knowledge and skills in diagnostic and therapeutic services, patient care, and health support services. These programs often allow students to earn an industry-recognized certification to document their skill level and advance their career options. For example, many schools offer programs where a student can work toward certification as a Licensed Practical Nurse (LPN) and/or Emergency Medical Technician (EMT).

Career Cluster 7

HUMAN RESOURCE SERVICES

INDUSTRY INSIGHTS

- The aging and growing diversity of the American population, advances in scientific knowledge, and increased public awareness of social problems and issues are contributing to a demand for more skilled social service workers and high-quality social services, including early childhood development; mental health/addiction; individual, family, and community; financial support; and workplace/workforce support. The emphasis in all these areas will shift to prevention and community-based services.
- Public concerns over crime, security, and emergency response and the increased demand for legal intervention in business and communities will continue to drive the growth of legal and court services. Advances in information technology and science will drive major innovations in law enforcement, emergency services, and legal services, including forensics, digital imaging, and global positioning systems.
- The new global economy will require all workers to have advanced education and continual upgrading of their skills. This need will fuel the growth of the education and training industry in both the public and private sectors, including K-12/postsecondary education, businesses, and businesses that provide training and development services to businesses.
- The demand of the new global economy and social and technological changes in the face of mounting pressures to control costs will lead to the reinvention of government services at the federal, state, and local levels. In particular, advances in information technology will transform how government agencies carry out their critical roles and functions.



Looking at this industry as a whole, five pathways represent the major functions in the industry. Career Pathways show more specific business activities that offer a range of related career opportunities. In the Career Pathways, a significant number of career options require at least a four-year college degree.

Appropriate work experience may also be important to increase career opportunities. The center circle represents the common knowledge and skills required of anyone in this career. As students focus on a more specific Career Pathway, they advance their readiness for careers in that pathway.

Career Cluster 7

HUMAN RESOURCE SERVICES

PATHWAY: LAW ENFORCEMENT AND EMERGENCY SERVICES

Protecting public safety through law enforcement, security and protective services, and fire and emergency services.

- Provide emergency rescue/medical and hazardous materials services.
- Provide correctional services.
- Enforce compliance with government laws and regulations.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Fire Marshal • Police Officer • Corrections Officer • Crime Technician • Dispatcher/Communications Officer • Fire Inspector • Fire Investigator • Security Officer-Public/Private 	<ul style="list-style-type: none"> • Parole Officer • Case Manager • Counselor • Forensic Scientist • Fire Protection Engineer • Police Agent 	<ul style="list-style-type: none"> • Federal Special Agent

PATHWAY: LEGAL SERVICES

Providing civil, criminal, juvenile, and administrative judicial/court services, dispute resolution, and legal assistance services.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Mediator/Arbitrator • Court Clerk • Court Reporter/Transcriber • Investigator • Legal Assistant 	<ul style="list-style-type: none"> • Assistant Court Commissioner • Paralegal • Legal Assistant • Law Clerk 	<ul style="list-style-type: none"> • Lawyer • Judge • Master • Administrative Law Judge • Court Commissioner • Hearing Examiner

PATHWAY: HUMAN SERVICES

Providing psychological, social, and community services support to individuals and to adolescents in school environments.

- Implement the following services: early childhood development; mental health/addiction; individual, family, and community; financial support; and work-place/workforce support.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Childcare Worker • Job Coach • Housing Specialist • Family Support Specialist • Child Support Worker • Human Services Associate • Community Organizer/Developer 	<ul style="list-style-type: none"> • Program Coordinator • Case Manager • Family Support Specialist • Employment Counselor • Childcare Licensing Specialist • Policy Specialist • Employee Assistance Counselor 	<ul style="list-style-type: none"> • Human Resource Administrator • Psychologist • Speech Therapist • Speech Pathologist

Career Cluster 7

HUMAN RESOURCE SERVICES

PATHWAY: GOVERNMENT AND PUBLIC ADMINISTRATION

Providing legislative, administrative, and judicial services to carry out general-purpose government functions at the federal, state, and local levels and to provide for national security.

- Implement national security policy.
- Manage international relations.
- Manage research and information.
- Administer revenue and taxation plans.
- Administer grant programs.
- Conduct regulatory compliance and investigative services.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Policy Researcher • Public Affairs Assistant 	<ul style="list-style-type: none"> • Program Manager • Financial Administrator • Auditor • Public Affairs/Information Specialist • Budget Analyst • Policy Analyst • Government Official • Campaign Manager 	<ul style="list-style-type: none"> • Financial Management Specialist • Accountant • Lawyer

PATHWAY: EDUCATION AND TRAINING SERVICES

Providing education and training services, performance support, and organizational development services to improve organizational effectiveness.

- Provide K-16 instructional services and support services within public and private schools and colleges.
- Conduct training and performance support services for organizations and employees.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Career and Technology Education Teacher • Teacher Assistant • Postsecondary Instructor • Laboratory Technician 	<ul style="list-style-type: none"> • Pre-K-12 Teacher • Librarian/Information Specialist • Career Counselor • Placement Specialist • Admission Counselor • Financial Aid Advisor • Trainer • Organizational Developer • Performance Consultant • Academic Advisor 	<ul style="list-style-type: none"> • College Professor • Curriculum Developer • School or Postsecondary Administrator • Non-Public Pre-K-12 Teacher/Montessori • Guidance Counselor • Testing and Assessment Specialist • Reading Specialist • School Psychologist • ESL Specialist • Extension Educator

Career Cluster 7

HUMAN RESOURCE SERVICES

CROSS-CLUSTER SKILL AREAS

In addition to focusing on a Pathway, students gain transferable skills across Career Clusters. These cross-cluster skills broaden a student's understanding of how different careers connect and intersect.

- **Information Technology and Communications Support:** Telecommunications, data and computer support services, including communications systems and devices, film and audio-visual services and equipment, computer software and hardware, and Internet services.
- **Financial Management and Accounting:** Business support services in finance and accounting, including budgeting and fiscal operations.
- **Legal Services:** Legal services that address all aspects of the organization, including purchasing contracts, leases, human resources, and risk management.
- **Government Relations/Legislative Affairs:** Managing government communications, lobbying, and managing relationships with government agencies at the federal, state, and local levels.
- **Human Resources/Training:** Business activities involved in recruiting and hiring employees, performance reviews, compensation and benefits management, labor relations, and compliance with government laws and regulations, and the training and development of employees, ranging from orientation to professional and management development.
- **Risk Management and Security:** Services that provide health, safety and environmental protection, insurance for employees and customers, loss prevention, compliance with government laws and regulations, and security.
- **Maintenance/Facility Support:** Services involving the maintenance of physical facilities, including architecture and design services, facility and equipment maintenance services, building cleaning services, and landscape and grounds planning and maintenance.
- **Marketing:** Market analysis, advertising, and promotion and communications services.
- **Health and Safety/Environmental Management:** Managing and improving health and safety, and maintaining compliance with legal and regulatory requirements, including OSHA and EPA.
- **Customer Relations:** Managing customer relations and insuring that customers receive the services they are promised and are satisfied with the services they receive.
- **Fundraising:** Seeking and securing financial resources for the organization, including government and foundation grants and corporate, community, and individual contributions.

PROGRAM HIGHLIGHT

HUMAN RESOURCE SERVICES

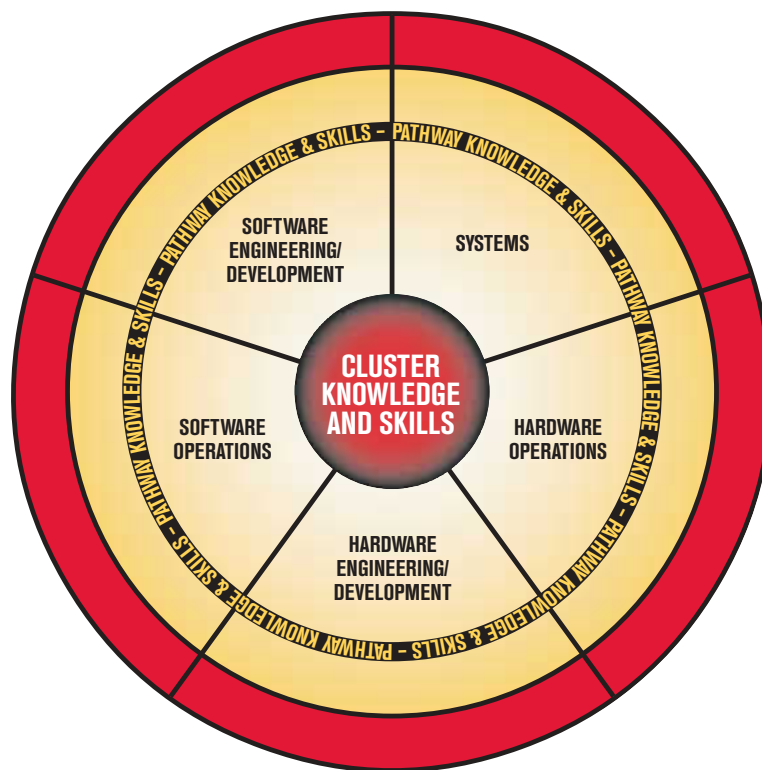
Teacher education programs offer high school students a Career Pathway in a highly needed profession—teaching. Courses such as the Academy of Teaching Professions and Early Childhood Development enable students to prepare for postsecondary teacher education programs while in high school.

Career Cluster 8

INFORMATION TECHNOLOGY

INDUSTRY INSIGHTS

- Advances in information technology will continue to drive major innovations across all major industries throughout the world. These advances will also change the face of government and the non-profit sector. Businesses will continue to expand the use of information technology in all aspects of the business enterprise and will seek more comprehensive e-commerce and information management solutions to remain competitive.
- Information technology businesses and professionals will face increasing pressure to design, develop, implement, and support more complex and reliable information technology solutions that will meet the needs of external and internal customers. This will require that information technology professionals have the skills to determine customer and business needs and requirements, manage complex projects, integrate software and hardware solutions, and deliver total solutions on time that meet customer needs.
- The rapid pace of technological change and increased global competition will require that information technology professionals develop and continually update high-level technical, project management, and customer relations skills.



Looking at this industry as a whole, five pathways represent the major functions in the industry. Career Pathways show more specific business activities that offer a range of related career opportunities. In the Career Pathways, a significant number of career options require at least a four-year college degree.

Appropriate work experience may also be important to increase career opportunities. The center circle represents the common knowledge and skills required of anyone in this career. As students focus on a more specific Career Pathway, they advance their readiness for careers in that pathway.

Career Cluster 8

INFORMATION TECHNOLOGY

PATHWAY: SOFTWARE ENGINEERING/DEVELOPMENT

Designing, developing, and testing software solutions to meet customer needs. Expertise required in project management, programming languages, database design, security systems, and website development.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Web Designer/Developer • Webmaster • Database Analyst • Database Tester • Data Analyst • Documentation Specialist • Software Applications Specialist 	<ul style="list-style-type: none"> • Software Architect • Lead Programmer • Project Manager • Software Applications Quality Assurance Specialist • Software Applications Engineer • Application Integrator 	<ul style="list-style-type: none"> • Business Analyst • Software Architect • Network Analyst • Operating Systems Designer/Engineer • Information Systems Architect

PATHWAY: SOFTWARE OPERATIONS

Installing, deploying, maintaining, and supporting software systems, including databases, software programs and packages, Web products, and security systems. Expertise required in project management.

- Monitor and manage software performance.
- Provide training and assistance to software users.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Applications Trainer • Web Administrator • Information Systems Administrator • Applications Support Specialist • Database Support Analyst • Call Center Support Representative 	<ul style="list-style-type: none"> • Operations Manager • Database Administrator • Operations Systems Analyst • Senior Database Administrator • Database Security Expert • Help Desk Product Support Engineer • Technical Support Engineer 	<ul style="list-style-type: none"> • Project Manager • Operations Manager • Operations Systems Analyst

PATHWAY: HARDWARE ENGINEERING/DEVELOPMENT

Designing, developing, and testing new hardware technologies and products to meet customer needs. Expertise required in project management.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Network Technician 	<ul style="list-style-type: none"> • Operations Manager • Computer Designer • Computer Engineer • Mechanical Engineer • Circuit Designer • Chip Designer • Network Engineer

Career Cluster 8

INFORMATION TECHNOLOGY

PATHWAY: HARDWARE OPERATIONS

Installing, configuring, maintaining, and supporting computer and network hardware to ensure secure and reliable system performance. Expertise required in project management.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Computer Technician • Network Technician • Cabling Technician • Help Desk Technician • Call Center Support Representative 	<ul style="list-style-type: none"> • Operations Manager • Network Administrator • Project Manager • Technical Editor • Technical Writer • Customer Service Representative • Help Desk Product Support Engineer

PATHWAY: SYSTEMS

Designing, implementing, and supporting computer network systems—both hardware and software—to ensure that systems meet business and user requirements. Expertise required in configuration management and project management.

- Plan and manage system development projects.
- Maintain system documentation.
- Control system access and maintain system security.
- Troubleshoot system performance problems.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Information System Administrator 	<ul style="list-style-type: none"> • Systems Analyst • Operations Systems Engineer • Network Engineer • Systems Test Engineer • Security Specialist 	<ul style="list-style-type: none"> • Systems Architect • Systems Engineer • Operations System Engineer • Security Analyst • Operations System Program Manager

Career Cluster 8

INFORMATION TECHNOLOGY

CROSS-CLUSTER SKILL AREAS

In addition to focusing on a Pathway, students gain transferable skills across Career Clusters. These cross-cluster skills broaden a student's understanding of how different careers connect and intersect.

- **Business and Administrative Services:** Core business and administrative services found in all businesses, including finance and accounting services, human resource services, and administrative support services.
- **Customer Sales/Service and Relationship Management:** All activities involved in identifying customers, building and completing customer sales, responding to customer requests, and maintaining customer relationships.
- **User Services:** All major applications support services provided to end users in major customer markets.
- **User Applications Services:** All activities related to providing technical support regarding user applications.
- **User Applications Documentation – Technical Writing:** Developing information on the use, operation, and capabilities of specific user applications.

PROGRAM HIGHLIGHT

INFORMATION TECHNOLOGY

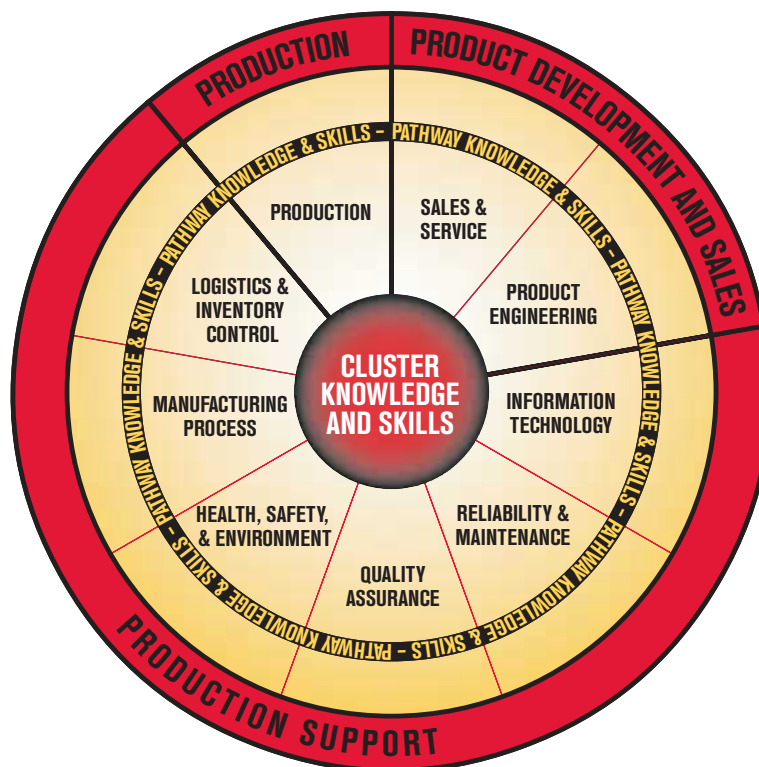
Maryland's Academy of Information Technology features two specialized courses each semester and a college-level course in the senior year. The program offers courses such as Introduction to IT, Information Systems, Logic for Programming, Digital Networks, System Support and Maintenance, Advanced Web Tools, Digital Media, Programming, and Databases. This program introduces students to the broad career opportunities in today's digital workforce and, in the process, equips them with the personal, analytical, technical, and communications skills they need to succeed.

Career Cluster 9

MANUFACTURING, ENGINEERING, AND TECHNOLOGY

INDUSTRY INSIGHTS

- The Maryland Manufacturing, Engineering, and Technology industry sector is an international enterprise with products that are designed, manufactured, and sold within a highly competitive global marketplace.
- American manufacturers are adopting leading global practices, such as lean manufacturing, to find new ways to produce high-quality products, better, faster, and more cost-effectively with as little waste as possible.
- American manufacturers face new health, safety, and environmental requirements and are searching for innovative ways to improve safety and lessen the environmental impacts of both products and processes. Advances in science and technology, such as materials science, engineering, and information technology, will continue to drive product and process innovation.
- With the increasing availability of information technology, the industry will use logistics and resource planning systems on a greater industry-wide basis. As supply chains become even more global, this will improve the way suppliers, manufacturers, and customers interact with each other.



Looking at the industry as a whole, three core areas—Production, Product Development and Sales, and Production Support—organize the pathways according to major functions in the industry. Within the core areas, Career Pathways show more specific business activities that offer a range of related career opportunities. In the Career Pathways, a significant number of

career options require at least a four-year college degree. Appropriate work experience may also be important to increase career opportunities. The center circle represents the common knowledge and skills required of anyone in this career. As students focus on a more specific Career Pathway, they advance their readiness for careers in that pathway.

Career Cluster 9

MANUFACTURING, ENGINEERING, AND TECHNOLOGY

CORE AREA 1: PRODUCTION

PATHWAY: PRODUCTION

Producing products and continuously improving production processes to meet customer and business requirements.

- Manage production operations.
- Operate and control production equipment.
- Provide technical support to production.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE

- Manufacturing Technician
- Production Assembler
- CAD/CAM Technician
- Production Supervisor
- Production Team Leader
- Production Operator
- Materials Management Specialist

REQUIRES FOUR-YEAR COLLEGE DEGREE

- Manufacturing Engineer
- Product Engineer
- Controls Engineer
- Systems Engineer
- Project Manager
- Program Manager

CORE AREA 2: PRODUCT DEVELOPMENT AND SALES

PATHWAY: PRODUCT ENGINEERING

Designing, developing, or modifying products to meet market and customer requirements.

- Design and develop products through concurrent engineering processes that integrate product and process development.
- Improve the manufacturability and sustainability of products.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE

- Engineering Technician
- CAD Technician

REQUIRES FOUR-YEAR COLLEGE DEGREE

- Manufacturing Engineer
- Six Sigma Manager
- Test Engineer
- Materials Engineer
- Systems Engineer

PATHWAY: MANUFACTURING SALES AND SERVICE

Marketing, selling, customer service, and overall customer relationship management.

- Identify and analyze customer value, markets, and products.
- Identify potential customers.
- Establish and maintain relationships with potential and existing customers.
- Promote and sell products and services to customers.
- Provide customer service, including providing product information, taking and processing customer orders, answering questions, resolving problems, and providing technical support in the use and disposal of products.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE

- Sales Agent
- Customer Service Representative
- Contract Specialist
- Sales Coordinator

REQUIRES FOUR-YEAR COLLEGE DEGREE

- Marketing Manager
- Sales Manager
- Customer Service Manager
- Sales and Application Manager

Career Cluster 9

MANUFACTURING, ENGINEERING, AND TECHNOLOGY

CORE AREA 3: PRODUCTION SUPPORT

PATHWAY: LOGISTICS AND INVENTORY CONTROL

Manage the supply chain from suppliers through production to end-use customers using enterprise-wide resource planning systems.

- Plan and control production.
- Manage purchasing and just-in-time materials flow, shipping and receiving, packaging, and transportation.
- Control inventory of material and products.
- Manage product support, including parts and warranty issues.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Expediter• Inventory Specialist• Material Handler• Contract Specialist• Information Technician	<ul style="list-style-type: none">• Logistics Analyst• Logistics Engineer• Production Planner and Scheduler• Inventory Manager• Purchasing Manager

PATHWAY: MANUFACTURING PROCESS

Designing, implementing, and continually improving manufacturing processes.

- Develop manufacturing process plans and documentation.
- Audit manufacturing processes and systems.
- Provide technical support to production to prevent errors, and reduce process variability and waste.
- Manage continuous process improvement.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• CAD/CAM Technician• Engineering Technician• Documentation Specialist	<ul style="list-style-type: none">• Process Engineer• Tooling Engineer• Manufacturing Engineer• Product Change Coordinator• Six Sigma Manager

PATHWAY: QUALITY ASSURANCE

Ensuring that products meet customer requirements and supporting continuous improvement.

- Determine customer requirements.
- Develop and implement quality systems, including monitoring processes and testing product quality.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Quality Technician• Inspector• Non-Destructive Tester• Documentation Control Technician• Product/Process Validation Specialist• Metrology/Calibration Specialist	<ul style="list-style-type: none">• Reliability Engineer• Quality Engineer• Mechanical Engineer• Six Sigma Manager

Career Cluster 9

MANUFACTURING, ENGINEERING, AND TECHNOLOGY

PATHWAY: RELIABILITY AND MAINTENANCE

Maintaining the reliability and performance of manufacturing systems to ensure the maximum utilization of capital assets.

- Select production equipment.
- Plan space and layout.
- Operate total productive maintenance systems.

PATHWAY: INFORMATION TECHNOLOGY

Designing, implementing, and supporting computer network systems (hardware and software) to ensure that systems—enterprise-wide resource management systems and e-commerce support systems—meet business and user requirements.

- Plan and manage system development projects.
- Install and configure network hardware and software.
- Maintain system documentation.
- Control system access and maintain system security.
- Troubleshoot system performance problems.
- Provide user training and support.

PATHWAY: HEALTH, SAFETY, AND ENVIRONMENTAL

Designing, planning, implementing, and supporting health and safety and environmental management systems to maintain organizational compliance with government laws and regulations.

- Improve health, safety, and environmental performance, such as moving toward zero discharge, designing for green, and recycling.
- Achieve organizational wellness through ergonomic and health promotion efforts.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE

- CAD/CAM Technician
- HVAC Technician
- Maintenance Mechanic
- Electrician
- Maintenance Technician

REQUIRES FOUR-YEAR COLLEGE DEGREE

- Facility Engineer
- Mechanical Engineer
- Electrical Engineer
- Six Sigma Manager
- Systems Engineer

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE

- User Support Specialist
- PC/System Technician
- Network Technician
- Software Support Specialist
- Web Administrator

REQUIRES FOUR-YEAR COLLEGE DEGREE

- Software Engineer
- Programmer
- Network Administrator
- System Engineer
- Knowledge Engineer
- Product Data Manager

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE

- Laboratory Technician
- Health and Safety Technologist

REQUIRES FOUR-YEAR COLLEGE DEGREE

- Safety Engineer
- Ergonomic Engineer
- Environmental Engineer
- Industrial Engineer
- Scientist
- Remediation Specialist

Career Cluster 9

MANUFACTURING, ENGINEERING, AND TECHNOLOGY

CROSS-CLUSTER SKILL AREAS

In addition to focusing on a Pathway, students gain transferable skills across Career Clusters. These cross-cluster skills broaden a student's understanding of how different careers connect and intersect.

- **Human Resources:** Business activities involved in recruiting and hiring employees, performance reviews, compensation and benefits management, labor relations, and compliance with government laws and regulations.
- **Training:** All types of learning services, including company and vendor training.
- **Legal Services:** Legal services that address all aspects of the business, including contracts, human resources, and risk management.
- **Financial Management and Accounting:** Financial and accounting services that manage financial resources and manage and report the revenues and costs of manufacturing businesses.
- **Security:** Business activities involved in property loss prevention and ensuring the personal security of employees.

MANUFACTURING, ENGINEERING, AND TECHNOLOGY

PROGRAM HIGHLIGHT

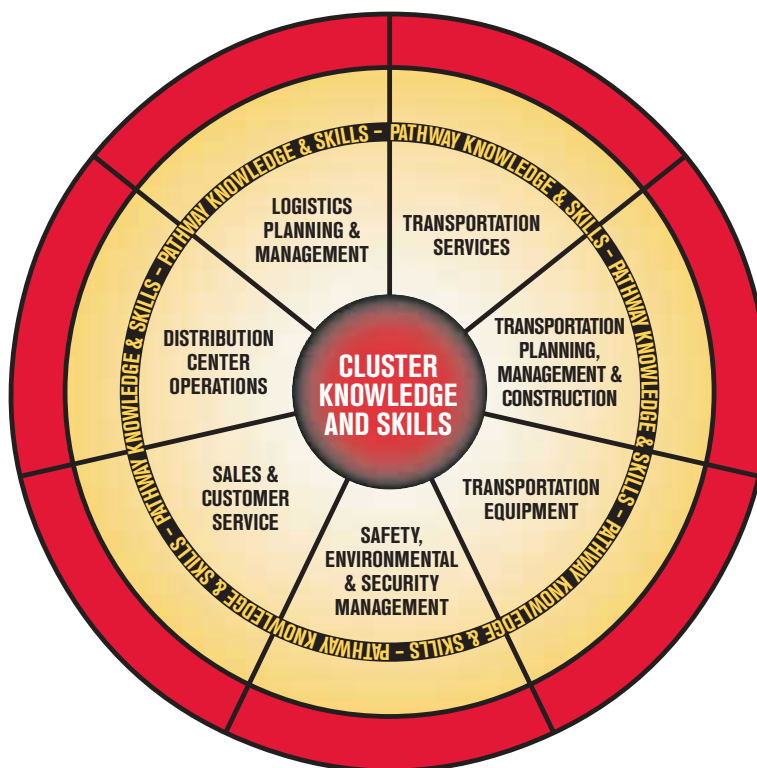
Maryland's Project Lead The Way program is a four-year sequence of courses which, when combined with traditional mathematics and science courses in high school, introduces students to the scope, rigor, and discipline of engineering and engineering technology prior to entering college. The courses include Engineering Design, Digital Electronics, Computer Integrated Manufacturing, and Engineering Design and Development. Introduction at this level attracts more students to engineering and allows students, while still in high school, to determine if engineering is the career they desire.

Career Cluster 10

TRANSPORTATION TECHNOLOGIES

INDUSTRY INSIGHTS

- The expansion of global trade and travel, and advances in logistics and distribution management in manufacturing and wholesale and retail trade are driving the growth of the transportation sector.
- The transportation sector is becoming increasingly integrated and intermodal across all types of transportation, including air, water, roadway, rail, and metropolitan transit systems. Many businesses are now providing comprehensive services, including logistics planning and management, inventory management, and transportation.
- Advances in science and engineering are producing major innovations in transportation technology, resulting in faster movement of people and goods at lower costs and with less environmental and safety risks. These innovations require higher skills to manage and maintain transportation equipment.
- Advances in transportation technology and information technology, the growth in global transportation, and increased security and safety concerns are creating the need for an expanded and more advanced public transportation infrastructure, including intelligent transportation systems, and advances in the management of this infrastructure at the local, state, and federal levels.



Looking at this industry as a whole, seven pathways represent the major functions in the industry. Career Pathways show more specific business activities that offer a range of related career opportunities. In the Career Pathways, career options are divided fairly evenly among those requiring less than a four-year college degree, those requiring a four-year college degree, and those

requiring more than a four-year college degree. Appropriate work experience may also be important to increase career opportunities. The center circle represents the common knowledge and skills required of anyone in this career. As students focus on a more specific Career Pathway, they advance their readiness for careers in that pathway.

Career Cluster 10

TRANSPORTATION TECHNOLOGIES

PATHWAY: TRANSPORTATION OPERATIONS

Moving people, freight (goods and materials), and information through one or multiple (intermodal) modes of transportation, including air, water, roadway, rail, and public transit systems.

- Dispatch, control, operate, and support mobile equipment, including trains, ships, airplanes, trucks, buses, and cars.
- Manage people, information, and inventory.
- Provide customer service.
- Communicate with and educate customers on improving the use of transportation services.
- Maintain and improve safety compliance and performance.

PATHWAY: LOGISTICS PLANNING AND MANAGEMENT

Planning and analyzing the movement of people, freight (goods and materials), and information. Managing organizational assets to improve the quality of services and lower costs.

- Select transportation modes and carriers.
- Locate transportation hubs and distribution centers.
- Develop transportation routes and schedules.
- Determine packaging and material handling requirements.
- Determine documentation and information requirements for domestic and international transporting.
- Analyze problems to improve performance.

PATHWAY: DISTRIBUTION CENTER OPERATIONS

Managing and operating warehouses and distribution centers.

- Process, sort, assemble, package, and handle incoming and outgoing materials and products.
- Manage people and provide customer service.
- Maintain and improve safety compliance and performance.
- Control inventories maintained within distribution centers.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Truck Driver• Pilot• Fueler• Air Traffic Controller• Dispatcher• Scheduler• Bus Driver• Ship Captain• Harbor Master• Flight Attendant• Conductor	<ul style="list-style-type: none">• Military Flight Operations Manager• Airport Manager• Quality Manager• Flight Service Manager• Business Process Engineer• Process Improvement Manager• Operations Manager• Terminal Manager

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• CAD Technician	<ul style="list-style-type: none">• Logistics Analyst• Traffic Engineer• Industrial Engineer• Demographer• Transportation Planner• CAD Engineer

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Forklift Operator• Warehouse Supervisor• Parts Manager• Hazardous Materials Specialist• Database Specialist• Inventory Specialist• Stationary Engineer	<ul style="list-style-type: none">• Industrial Engineer• Distribution Center Manager• Inventory Manager• Quality Control Manager• Import/Export Manager• Logistics Engineer• Industrial Engineering Technician

Career Cluster 10

TRANSPORTATION TECHNOLOGIES

PATHWAY: SAFETY, ENVIRONMENTAL, AND SECURITY MANAGEMENT

Complying with government laws and regulations in safety, health, and environmental management. Maintaining security in transportation facilities and operations.

- Prevent and reduce losses due to theft and product damage.
- Investigate safety, environmental, and security problems, and improve performance.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Safety or Environmental Inspector • Accident Investigator • Material and Equipment Inspector • Emergency Manager • Emissions Inspector • Coast Guard Officer • Security Investigator 	<ul style="list-style-type: none"> • Environmental Analyst • Public Administrator • Traffic Safety Officer • Civil Engineer • Occupational Safety Officer • Air Marshal • Customs Officer • Process Improvement Manager 	<ul style="list-style-type: none"> • Lawyer

PATHWAY: TRANSPORTATION PLANNING, MANAGEMENT, AND CONSTRUCTION

Planning, designing, constructing, and maintaining public and private transportation facilities and infrastructure, including highways, ports, airports, and train terminals and railways.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Construction Supervisor • Engineering Technician • Drafter/CAD Technician • Surveyor • Security Engineer • Facility Engineer 	<ul style="list-style-type: none"> • Transportation Planner • Traffic Engineer • Civil Engineer • Highway Engineer • Real Property Officer • Environmental Specialist 	<ul style="list-style-type: none"> • Government Agency Administrator • Architect • Lawyer

PATHWAY: SALES AND CUSTOMER SERVICE

Promoting and selling logistics and transportation services and equipment, and providing ongoing customer service to businesses and consumers.

SAMPLE CAREER OPTIONS

REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none"> • Reservation Agent • Customer Service Representative • Salesperson • Service Writer • Leasing Specialist • Title/Registration Administrator 	<ul style="list-style-type: none"> • General Manager • Market Analyst • Marketing Manager • Sales Manager • Parts Manager • Contract Officer • Procurement Officer • Finance Specialist

Career Cluster 10

TRANSPORTATION TECHNOLOGIES

PATHWAY: TRANSPORTATION EQUIPMENT

Planning, designing, manufacturing, and maintaining transportation equipment, including automobiles, trucks, buses, airplanes, ships, and trains.

SAMPLE CAREER OPTIONS		
REQUIRES LESS THAN FOUR-YEAR COLLEGE DEGREE	REQUIRES FOUR-YEAR COLLEGE DEGREE	REQUIRES MORE THAN FOUR-YEAR COLLEGE DEGREE
<ul style="list-style-type: none">• Parts Manager• Automotive Technician• Collision Repair Technician• Fleet Maintenance Manager• Airframe Mechanic• PowerPoint Mechanic• Diesel Mechanic• Railcar Technician• Materials Specialist• Welder	<ul style="list-style-type: none">• Mechanical Engineer• Aerospace Engineer• Design Engineer• Structural Engineer• Electrical Engineer• Computer Engineer• Mechanical Engineer• Manufacturing Operations Manager• Manufacturing Engineer• Process Engineer• Integration Engineer	<ul style="list-style-type: none">• Civil Engineer• Systems Engineer• Quality Engineer

Career Cluster 10

TRANSPORTATION TECHNOLOGIES

CROSS-CLUSTER SKILL AREAS

In addition to focusing on a Pathway, students gain transferable skills across Career Clusters. These cross-cluster skills broaden a student's understanding of how different careers connect and intersect.

- **Information Technology and Communications Support:** Telecommunications, data, and computer support services, including communications systems and devices and equipment, computer software and hardware, and Internet services.
- **Financial Management and Accounting:** Business support services in finance and accounting.
- **Purchasing and Procurement:** Purchasing materials and equipment for organizations involved in performing and distributing.
- **Legal Services:** Legal services that address all aspects of the business, including purchasing contracts, leases, human resources, and risk management.
- **Public Policy/Government Relations:** Managing government communications, lobbying, and managing relationships with government agencies at the federal, state, and local levels.
- **Human Resources/Training and Labor Relations:** Business activities involved in recruiting and hiring employees, conducting performance reviews, handling compensation and benefits management, labor relations, and complying with government laws and regulations. It also refers to the training and development of employees, ranging from orientation to professional and management development.
- **Marketing and Sales:** Market analysis, advertising and promotion, sales, and customer service.
- **Construction Equipment and Material Supply:** Providing necessary construction equipment and materials to construct transportation facilities and infrastructure.

PROGRAM HIGHLIGHT

TRANSPORTATION TECHNOLOGIES

Transportation logistics is the universal pipeline through which shipments of products or services between suppliers, manufacturers, and customers are transported all over the world. The Mid-Atlantic Transportation and Logistics Institute was established to meet the need for professionals in this Career Pathway. The Institute is a national public/private partnership among federal, state and local government agencies, businesses, industry organizations, high schools and two-and four-year colleges/universities. Programs of study offer students up to 12 college credits while in high school. Students can continue their education to earn an Associate of Applied Science Degree or a certificate in commercial transportation or materials management.

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IN A TECHNOLOGICALLY ADVANCED, GLOBAL SOCIETY

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